gen sulphide or with the precipitation of atomic sulphur. In such a water, therefore, the number of bicarbonate ions is gradually decreasing as the number of the hydroxyl ions is increasing. The acidity of calcium and magnesium chlorides toward the alkaline sulphides is pronounced but has less effect on the bicarbonates.

Although the addition of a few cubic centimeters of neutral barium chloride solution to an ordinary carbonate water aids in breaking up the bicarbonate ions, it has no such effect if the water contains a considerable quantity of alkaline sulphides.

Hydrogen sulphide is volatilized much quicker and more completely at boiling than at room temperature, but a certain percentage is not expelled by a rapid current of hydrogen even after one or two hours.

A discussion of the reduction of sulphates by organic matter has been published by C. E. Siebenthal.[2] The author has been able to produce noticeable amounts of $H_2S$ in a hydrogen generator containing about 20 per cent $H_2SO_4$, about 0.5 gm. NaCl, some KI and $SnCl_2$, some $CaSO_4$ and organic matter derived from the oxidation of fruit in nitrosulphuric acid. The $H_2S$ was sufficiently strong to mask the Gutzeit test made for arsenic.

Acknowledgment is due to Dr. Chase Palmer, recently of the United States Geological Survey, at whose suggestion and with whose cooperation this work was undertaken and carried out.

CONCHOLOGY.—*The Caecidae and other marine mollusks from the northwest coast of America.*[1] PAUL BARTSCH, U. S. National Museum.

The "Summary of the Marine Shell Bearing Mollusks of the Northwest Coast of America," by Dr. William H. Dall, about to be published by the U. S. National Museum as Bulletin 112, contains references to a number of species, of which no descrip-

[2] U. S. Geol. Survey Bull. **606**: 62–66. 1916.

[1] Published by permission of the Secretary of the Smithsonian Institution. Received October 22, 1920.

tions have as yet been published. I have therefore briefly characterized these forms in the present paper to give a proper status to these names.

The family Caecidae is being subjected to a thorough revision at the present time by the writer, and only those West American forms which are listed in the above mentioned summary are considered here. The species belonging to the region farther south will be dealt with in the fuller report.

### Key to the Genera of the Family Caecidae

Operculum conic.....*Brochina.*
Operculum flat or concave.
  Sculpture absent (excepting incremental lines).....*Fartulum.*
  Sculpture not absent.
    Sculpture of raised spiral ridges only.....*Elephantulum.*[2]
    Sculpture not of raised spiral ridges only.
      Sculpture of raised spiral ridges and axial rings...*Elephantanellum.*
      Sculpture of axial rings only.
        Axial rings strong and distantly spaced.....*Caecum.*
        Axial rings slender and closely spaced.....*Micranellum.*

**Fartulum** Carpenter, Cat. Mazatlan Shells, 525. 1856.

Shell smooth, excepting microscopic incremental lines. Type *Caecum laeve* C. B. Adams.

The genus *Fartulum* is represented by four species in our Northwestern waters, of which three are undescribed. Of these, *F. orcutti* Dall is the smallest and has the aperture slightly contracted. It is also somewhat laterally compressed, which lends the aperture an oval outline. The other three species are circular in section. Of these, *F. occidentale* is the largest. This has scarcely an indication of a lateral spur to the plug, while in *F. hemphilli* and *F. bakeri* a well developed claw-like spur is present. *Fartulum hemphilli* is always larger in equivalent stages and lighter colored than *F. bakeri*.

[2] Since the early whorls are coiled in planorboid fashion, and the adolescent and adult stages are simply portions of the solutely coiled part, it is proper to refer to the sculpture that coincides with the incremental lines, that is parallels the aperture, as *axial*, and that at right angles to this as the *spiral*. The latter, therefore, coincides with the long axis of the adolescent and adult shell. This nomenclature is used in conformity with that employed in all my former papers on Gastropods.

TABLE 1

ADDITIONAL DATA PERTAINING TO THE ABOVE FARTULUMS

| | Cat. No. U. S. N. M. | Height in mm. | Diameter in mm. | Type locality |
|---|---|---|---|---|
| **Fartulum orcutti,** Dall..... | 60927 Type | 2.1 | 0.7 | San Diego. |
| **Fartulum occidentale,** sp. nov.. | 152166 Type | 3.1 | 0.9 | San Pedro. |
| **Fartulum hemphilli,** sp. nov.... | 340728 Type | 3.1 | 0.7 | San Pedro. |
| **Fartulum bakeri,** sp. nov..... | 340729 Type | 2.5 | 0.6 | San Pedro. |

*Fartulum orcutti* Dall is the most abundant species on the West Coast; thousands of specimens have been examined. It ranges from San Pedro to Lower California. *F. occidentale* Bartsch is also abundant, and ranges from San Pedro to Lower California. *F. hemphilli* Bartsch is rather rare, and occurs from San Pedro to Lower California. *F. bakeri* Bartsch is very abundant, ranging from San Pedro to Lower California.

**Elephantanellum,** gen. nov.

Surface of shell marked by raised ridges which coincide with the long axis of the shell; annulations strongly developed; operculum thin, corneous, concave. Type *Caecum hexagonum* Cpr.

The genus *Elephantanellum* has a number of representatives in the more southern waters of the Pacific. From north of San Diego, only a single species is known, **Elephantanellum carpenteri,** sp. nov. This is a large thin shell, in which the segments of all stages are marked by very fine spiral sculpture and a little stronger incremental lines, while the last portion of these stages bears well developed annuli. These increase in number in succeeding stages. The type, Cat. No. 340726, U. S. N. M., comes from San Diego and measures: length, 4.8 mm.; diameter, 0.9 mm. We have seen it from various stations from San Pedro south to Lower California.

**Caecum** Fleming, Edinb. Encycl. 7: 97. 1817.

*Brochus* Brown, Ill. Rec. Conch. Great Britain, 124–125, in part. 1827.
*Cornuoides* Brown, Ill. Rec. Conch. Great Britain, 125, in part. 1827.
*Odontina* Zborzewski, Mem. Soc. Nat. Mosc. 3: 310. 1834.
*Odontidium* Philippi, Moll. Sci. Utr. 1: 102. 1836.
*Anellum* Carpenter, Cat. Mazatlan Shells, 319. 1856.

Surface of the adult shell marked by numerous axial annulations. Operculum thin, corneous, concave. Type *Dentalium trachea* Montagu.

Five species of *Caecum* are known living on our Pacific shores north of San Diego. Four of these are undescribed. Some of the unnamed forms have at times been listed under names bestowed by Carpenter and Adams upon species occupying a more southern habitat. Three of these five species, *Caecum californicum*, *C. dalli* and *C. grippi* are robust forms and are much larger than the other two, *C. licalum* and *C. diegense*. *Caecum californicum* is larger than *C. dalli* and *C. grippi* and has about forty strong annuli, separated by narrow spaces, while *C. dalli* and *C. grippi* are of about the same size; the former has about twenty annuli on the last segment, while the latter has only about fifteen. While the annuli are of almost the same width, the spaces between them are much wider in *C. grippi* than in *C. dalli*. *Caecum licalum* has about eighteen broad annuli, while in *C. diegense* about twenty narrow slender rings are present.

TABLE 2

ADDITIONAL DATA PERTAINING TO THE ABOVE CAECUMS

| | Cat. No. U. S. N. M. | Height in mm. | Diameter in mm. | Type locality |
|---|---|---|---|---|
| **Caecum dalli,** sp. nov. | 340724 Type | 2.5 | 0.7 | San Diego. |
| **Caecum grippi,** sp. nov. | 206961 Type | 2.3 | 0.7 | San Diego. |
| **Caecum licalum,** sp. nov. | 340725 Type | 2.2 | 0.5 | San Diego. |
| **Caecum diegense,** sp. nov. | 340726 Type | 2.0 | 0.4 | San Diego. |
| **Caecum californicum** Dall. | 15719 Type | 2.8 | 0.8 | San Diego. |

*Caecum californicum* Dall is the most abundant West American *Caecum*. It is known from many stations from Monterey, California, to Lower California. *C. dalli* Bartsch is known from many stations from San Diego to Lower California, *C. licalum* Bartsch from San Pedro and San Diego. *C. diegensis* Bartsch has only been reported so far from the littoral zone at San Diego. *C. grippi* Bartsch was dredged in 15–20 fathoms off San Diego.

**Micranellum,** gen. nov.

Surface of the shell marked by closely spaced, slender, axial annulations; operculum thin, corneous, concave. Type *Caecum crebricinctum* Carpenter.

Seven species of *Micranellum* are known living in northwestern America. Five of these have the plug at the truncated apex forming an attenuated, obliquely placed spur, the base of which is narrower

than the diameter of the plug. Of these three—*Micranellum pedroense*, *catalinense*, and *profundicolum*—have the anterior portion of the adult shell bulbously expanded, while in the other two, *M. barkleyense* and *oregonense*, the diameter does not increase at the anterior termination. Of those with the bulbously expanded anterior portion, *M. pedroense* has very fine closely spaced annulations, there being about a hundred present in the adult segment of the shell, while in *M. catalinense* and *profundicolum* the annuli are less numerous and more pronounced, there being about seventy-five in the last segment. The shell of *M. catalinense* is shorter and stouter than that of *M. profundicolum*. The two species which lack the bulbous anterior expansion, *M. barkleyense* and *oregonense*, are distinguished from each other at once by their great difference in size, *M. barkleyense* being both longer and thicker than *Micranellum oregonense*.

Two of the seven species, *M. rosanum* and *crebricinctum*, have the spur of the plug expanded basally to cover the entire width of the plug. Of these, *M. rosanum* is easily distinguished from *M. crebricinctum* by being much longer and having the annuli much more distinct than *M. crebricinctum*.

TABLE 3

ADDITIONAL DATA PERTAINING TO THE ABOVE MICRANELLUMS

| | Cat. No. U. S. N. M. | Height in mm. | Diameter in mm. | Type locality |
|---|---|---|---|---|
| **Micranellum pedroense**, sp. nov | 346723 Type | 5.3 | 1.5 | San Pedro. |
| **Micranellum catalinense**, sp. nov | 211331 Type | 4.5 | 1.3 | Off Santa Rosa Island. |
| **Micranellum profundicolum**, sp. nov | 209960 Type | 5.5 | 1.3 | Off San Diego. |
| **Micranellum barkleyense**, sp. nov | 211589 Type | 6.2 | 1.6 | Barkley Sound, Vancouver Id. |
| **Micranellum oregonense**, sp. nov | 216413 Type | 4.6 | 1.2 | Forrester Island, Alaska. |
| **Micranellum rosanum**, sp. nov. | 211859a Type | 6.9 | 1.2 | Off Santa Rosa Island. |
| **Micranellum crebricinctum** Carpenter | 14930 Type | 6.2 | 1.3 | San Diego. |

*Micranellum pedroense* Bartsch is a shallow water form known to range from San Pedro to San Diego. *M. catalinense* is a deep water species, known from about 50 fathoms from Santa Rosa and Catalina Islands. *M. profundicolum* is a deep water form known from 55 to 199 fathoms off San Diego. *M. barkleyense* has so far been recorded only from Barkley Sound in 8 to 32 fathoms, *M. oregonense* only from shallow water, at Forrester Island, Alaska, and *M. rosanum* only from a station off Santa Rosa Island in 48 fathoms. *M. crebricinctum* Carpenter is a shallow water species abundantly distributed from Monterey to Lower California.

**Turbonilla** (Chemnitzia) **engbergi,** sp. nov.

Shell small, elongate conic, thin, semitransparent, bluish white. Nuclear whorls decollated. Postnuclear whorls moderately rounded, appressed at the summit, marked by broad, slightly protractively slanting axial ribs, of which fourteen occur upon all of the remaining turns, except the last, on which there are sixteen. These ribs are a little broader than the spaces that separate them, and they become slightly flattened and weaker toward the summit. The intercostal spaces are deeply depressed pits, which terminate somewhat posterior to the summit of the succeeding turn, leaving a broad, smooth band at the suture. Suture strongly constricted. Periphery of the last whorl well rounded, not crossed by the strong axial ribs. Base short, well rounded, marked by incremental lines only. Aperture subquadrate, posterior angle obtuse; outer lip thin; inner lip slightly sinuous, decidedly obliquely inserted, the inner edge having a decidedly protractive slant; parietal wall devoid of callus.

The type and another specimen, Cat. No. 334489, U. S. N. M., were collected by Dr. C. C. Engberg at San Juan Island, in the Gulf of Georgia. The type has almost 8 whorls remaining and measures: altitude, 3.7 mm.; diameter, 1.1 mm. Four additional specimens from the same station are in Dr. Engberg's collection.

This species occurs considerably farther north than any heretofore known *Chemnitzia*.

**Odostomia** (Amaura) **engbergi,** sp. nov.

Shell elongate ovate, yellow, a little paler toward the tip. Nuclear whorls eroded in all the specimens seen. Postnuclear whorls narrowly tabulatedly shouldered at the summit, quite strongly rounded, marked by very fine slightly slanting lines of growth and equally fine spiral striations, the combination, when viewed under the microscope, giving to the surface a cloth-like texture. Suture strongly marked. Periphery of the last whorl inflated, strongly rounded. Base strongly rounded. Aperture narrowly ovate; posterior angle very obtuse; outer lip thin; inner lip short, very oblique, somewhat sinuous, reflected over

the base and appressed to it except at the extreme tip, which alone is free; a strong fold is present on the inner lip a little anterior to its insertion; parietal wall covered by a thin callus.

The type and three additional specimens, Cat. No. 334492, U. S. N. M., were collected by Dr. Engberg off San Juan Island, Gulf of Georgia. The type has a little more than 5 whorls and measures: altitude, 7 mm.; diameter, 3.4 mm. Eight additional specimens from the same station are in Dr. Engberg's collection.

### Odostomia (Amaura) sanjuanensis, sp. nov.

Shell elongate ovate, wax yellow. Nuclear whorls decollated. Postnuclear whorls narrowly tabulatedly shouldered, moderately rounded, marked by regular retractively slanting lines of growth and fine spiral striations, which give to the surface a cloth-like texture when subjected to high magnification. In addition to this sculpture, the surface of the shell is marked by strong incremental lines and more or less irregular and irregularly distributed spiral threads, which produce a malleated pattern. Suture strongly marked. Periphery of the last whorl well rounded. Base moderately long, well rounded, marked like the spire. Aperture obliquely ovate; posterior angle obtuse; outer lip thin; inner lip very obliquely retractively slanting, somewhat flexuose and provided with a strong fold at its insertion; parietal wall covered by a thin callus.

The type, Cat. No. 334491, U. S. N. M., was collected by Dr. C. C. Engberg near San Juan Island, Gulf of Georgia. It has $5\frac{1}{2}$ whorls and measures: altitude, 7.2 mm.; diameter, 3.5 mm. Another specimen from the same locality is in Dr. Engberg's collection.

### Odostomia (Amaura) washingtonia, sp. nov.

Shell moderately large, broadly elongate conic, pale horn colored. Nuclear whorls too eroded to permit of description. Postnuclear whorls strongly tabulatedly shouldered at the summit, moderately rounded, marked by decidedly retractively slanting lines of growth and numerous very finely incised spiral striations. Sutures conspicuously marked by the tabulated summit. Periphery of the last whorl inflated, strongly rounded. Base short, inflated and strongly rounded, marked like the spire. Aperture rather large, almost subquadrate, slightly oblique; posterior angle obtuse; outer lip thin; inner lip flexuose, reflected over the base, but not appressed, the axis being decidedly protractively slanting. A strong columellar fold is present at the umbilical chink. Parietal wall covered by a thick callus.

The type, Cat. No. 334490, U. S. N. M., was collected by Dr. C. C. Engberg at San Juan Island, Gulf of Georgia. It has 7 whorls and measures: altitude, 8.7 mm.; greater diameter, 4.2 mm. The decidedly turreted outline of this shell, together with its broadly conic shape, will distinguish it at once from any of the other West Coast Amauras.

**Alaba catalinensis,** sp. nov.

Shell elongate conic, milk white, early whorls well rounded, the succeeding turns a little less so. All whorls polished, appressed at the summit, and marked by fine retractively slanting lines of growth. Beginning with the second turn, varicial thickenings make their appearance; these are very feeble on the early whorls, but increase steadily in strength until on the last turn they form decidedly raised sinuous ridges. The last whorl, too, shows well marked malleations. Aperture oval; posterior angle obtuse; inner lip curved and reflected, but not appressed to the base; parietal wall covered by a thick callus.

The type, Cat. No. 213369, U. S. N. M., was collected by Dr. S. S. Berry in 40 fathoms, off Catalina Island, California. It has ten and a half whorls and measures: length, 5.3 mm.; diameter, 1.9 mm. It is at once distinguished from the other two West American species by the absence of incised spiral lines.

**Cyclostremella concordia,** sp. nov.

Shell very small, planorboid, hyaline, semitransparent. Early whorls eroded in all the specimens seen. Yhe last two whorls curve suddenly to the deeply channeled suture on the upper surface; the rest gradually, evenly rounded. Periphery of the last whorl well rounded, Base openly umblicated. The entire surface of spire and base is marked by rather strong, irregularly developed incremental lines and more or less equal and equally spaced fine spiral lirations. The intersections of these two sculptural elements give to the surface of the shell the characteristic beaded sculpture of the genus. Aperture very broadly ovate, almost subcircular, the narrower portion being at the posterior angle; peristome thin, not reflected; parietal wall covered by a thin callus. Operculum thin, corneous, paucispiral.

The type and two additional specimens, Cat. No. 340862, U. S. N. M., were collected by Professor Carl C. Engberg at Olga, Washington. The type measures: altitude, 1 mm.; diameter, 2 mm. Two additional specimens from the same locality are in Professor Engberg's collection. The Museum also has specimens from Friday Harbor, Washington.

This species has been known from the last named locality under the names of *Skenia*, and *Skeniopsis planorbis* Fabr.

It is easily distinguished from its nearest neighbor, *Cyclostremella californica* Bartsch, by its smaller size, more robust form and weaker sculpture.